



# Field Portable Detection of VOCs Using a SAW/GC System



**Developer:** Amerasia (Electronic Sensor Technology)

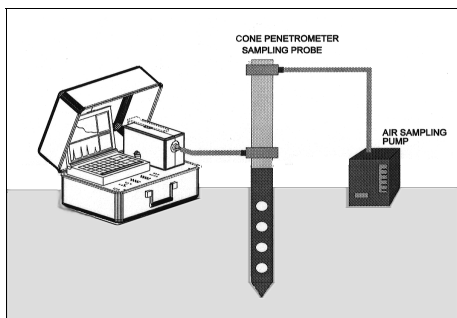
**Contract Number:** DE-AR21-94MC31177

**Crosscutting Area:** CMST

Subsurface  
Contaminants  
FOCUS AREA

## Problem:

Field personnel are currently hampered in identifying hazardous materials and for monitoring toxic waste site cleanups. Current methods are to setup mobile laboratories with highly skilled technicians and chemists at the site or to obtain samples and transport them to a regional laboratory for identification and analysis. Either option is time consuming and expensive.



## Solution:

Electronic Sensor Technology (EST), a Division of Amerasia Technology, Inc., has developed a portable, highly sensitive, rugged vapor detector system (Model 4100 Trace Vapor Analyzer) which provides for low-cost, accurate vapor detection and analysis. Its

purpose is to provide a low cost instrument for identifying hazardous materials and for monitoring Department of Energy (DOE) waste site cleanups throughout the United States.

The Model 4100 has the following specifications:

- Dimensions 14 by 20 by 10 inches
- Weight 35 lb. (15.9 kg.)
- Analysis Time from 5 seconds to 2 minutes
- Portable testing between \$30,000 to \$50,000
- High Sensitivity (50 picograms, or parts per trillion)
- Dynamic range of more than 8 orders of magnitude
- High sample rate (5 to 20 seconds)
- Low detection threshold (parts per trillion)
- Fast column settling time (5 seconds)
- Eight hour operation with a refill helium gas carrier

The following selected compounds and their chemical properties are not inclusive of all of the substances eligible for analysis.

Minimum  
Detection

Constituent	Limit (ppb)
Trichloroethylene	10
Tetrachloroethylene	3
Carbon Tetrachloride	70
Chloroform	65
Dichloromethane	600
1,2-Dichloroethane	370
1,1,1-Trichloroethane	3,570
cis-Dichloroethylene	110
1,1,2,2-Tetrachloroethane	1.3
Trichlorofluoromethane	25,640
Benzene	45
Toluene	4.5
Ethylbenzene	2.0
O-Xylene	2.0
Gasoline	10-100
Diesel Fuel	1

## Benefits:

- Based upon the application, responds to both vapor and particle material media.
- Can be configured for stand alone uses or integrated with other systems.
- Can be used in the lab or on-site.
- Can be used in water, soil, vapor and particle mediums and is



expected to be used in the following situations:

User: EPA/DOE Environmental Monitoring

Technology Application: chemical processes, fugitive emissions, OSHA/CAA materials, environmental monitoring to include surface, subterranean, and atmospheric monitoring

User: Industrial Monitoring

Technology Application: stack emissions, dioxins, particle chemical processes, incineration, and continuous emission monitoring (CEM), toxic gas, combustibles, oxygen depletion

User: Law enforcement, military

Technology Application: contraband, drugs, explosives, lethal chemicals, toxic gas warfare

### **Technology:**

The Model 4100 utilizes a patented piezoelectric Surface Acoustic Wave (SAW) resonator device and capillary gas chromatography. The result is a portable system that provides high detection specificity, selectivity, and sensitivity. The SAW resonator sensor has excellent recovery characteristics and provides a trace analysis in less than 30 seconds.

The figure displays the Model 4100 attached to a cone penetrometer sampling tube for ground sample analysis. The Model 4100 consists

of a portable gas chromatograph (GC) a SAW sensor, and a dynamic particle/vapor capture head. The three components are shock mounted in a rugged field-portable fiberglass carrying case. The Model 4100 captures the sample in a cryogenic focus chamber. The chamber deposits the sample upon the SAW sensor. The SAW sensor determines the change in its mass density and reports it to the database maintained in a laptop computer.

The Model 4100 database identifies the suspect sample through an analysis of the numerous chemical signatures it has previously identified and recorded. The analysis is then displayed with both visual and numerical data results. The operator also has an electronic scratch pad to enter any notes or comments. The system uses software (developed by Amerasia) which integrates a proprietary database system with Microsoft Windows.

### **Project Conclusion:**

This project was completed in September 1996. EST continues to market the Model 4100 Trace Vapor Analyzer for environmental applications, as well as, for detection of narcotics, explosives, nerve agents and applications for employee safety, food processing and medical fields. For more information on the Model 4100, visit the EST Homepage at <http://www.estcal.com>.

### **Contacts:**

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